

## Patent Abstracts of Japan

PUBLICATION NUMBER : 08187563  
 PUBLICATION DATE : 23-07-96

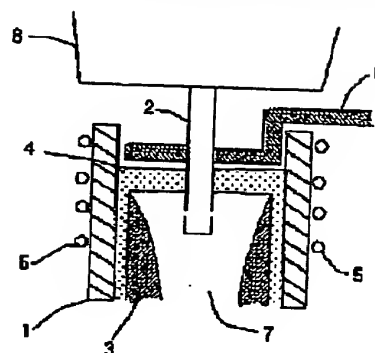
APPLICATION DATE : 06-01-95  
 APPLICATION NUMBER : 07015590

APPLICANT : NKK CORP;

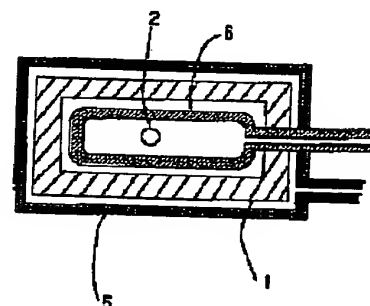
INVENTOR : NAKADA MASAYUKI;

INT.CL. : B22D 11/16 B22D 11/04 B22D 11/07  
 B22D 11/10

TITLE : CONTINUOUS CASTING METHOD  
 APPLYING ELECTROMAGNETIC  
 FORCE



(a)



(b)

ABSTRACT : PURPOSE: To improve the lubricity between a mold and a cast slab and to cast a cast slab having little surface fault by impressing high frequency induction electromagnetic force to near a meniscus part of molten metal from the outer part of the mold and also, from the inner part of the mold.

CONSTITUTION: When Lorentz's force acts in the direction of getting away from a coil by the high frequency induction magnetic field impressed from the outer part of the mold, at the time of negative strip, the molten steel 7 is allowed to overflow from the tip part of shell 3 to form newly the shell. At this time, since the shell is formed at the position distant from the mold 1 by the electromagnetic force directed inward, the interval for flowing of the powder 4 between the mold 1 and the solidified shell 3 is widened and tensile stress loaded to the shell by the movement of the mold 1 at the time of the negative strip is reduced. Further, Joule heat caused by induction current is given to the meniscus part with the high frequency induction magnetic force impressed from the inner part of the mold, and the meniscus part marked with oscillation mark is heated and the depth of the mark is made to be shallow.

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PUBLICATION NUMBER : 09182941  
PUBLICATION DATE : 15-07-97

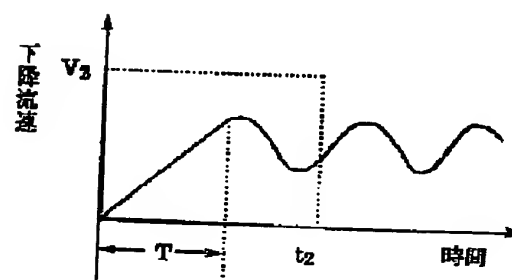
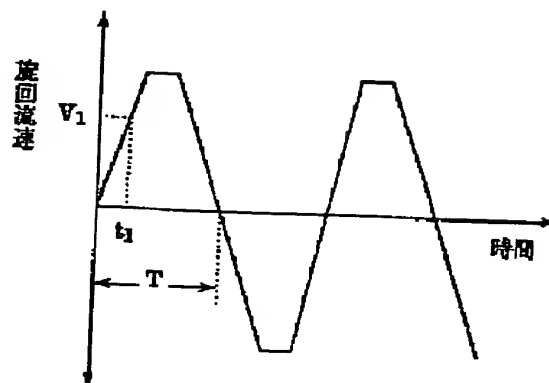
APPLICATION DATE : 28-12-95  
APPLICATION NUMBER : 07343111

APPLICANT : NIPPON STEEL CORP;

INVENTOR : KANEYASU TAKAYUKI;

INT.CL. : B22D 11/10 B22D 11/10

TITLE : ELECTROMAGNETIC-STIRRING  
METHOD FOR MOLTEN STEEL IN  
CONTINUOUS CASTING MOLD



ABSTRACT : PROBLEM TO BE SOLVED: To provide an electromagnetic stirring method of a molten steel in a mold which prevents the diffusion of inclusion to the lower part from the stirring part while restraining the growth of the descending flow, in a continuous caster.

SOLUTION: This molten steel stirring method is the one which applies the electromagnetic force in the opposite direction along the long side walls in the mold in the continuous caster, generates circular flow in the mold and periodically changes the stirring direction for restraining the growth of the descending flow to execute the unstationary stirring. A reverse period at this time is preferred to execute in the small range having sufficiently longer than a necessary time ( $t_1$ ) to accelerate till a necessary circulating flow speed ( $V_1$ ) to secure the surface quality and shorter a time ( $t_2$ ) till reaching a lower limit value ( $V_2$ ) of the descending flow speed for securing the internal quality to made this in the stirring direction  $1\text{sec} < T < 10\text{sec}$ .

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PUBLICATION NUMBER : 08267197  
PUBLICATION DATE : 15-10-96

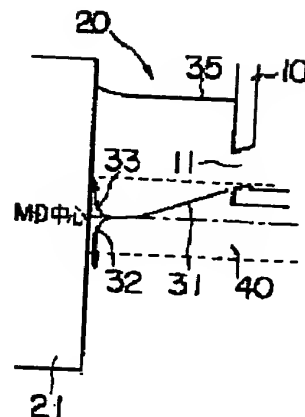
APPLICATION DATE : 31-03-95  
APPLICATION NUMBER : 07075140

APPLICANT : NISSHIN STEEL CO LTD;

INVENTOR : SHIMADA KIYOKUNI;

INT.CL. : B22D 11/10 B22D 11/10

TITLE : METHOD FOR CONTROLLING  
FLUIDITY OF MOLTEN STEEL IN  
MOLD



**ABSTRACT :** PURPOSE: To execute a continuous casting operation while minimizing the variation of the fluidity of molten steel and preventing the inclusion defect by giving the gradient in the variation of magnetic flux density particularly at the time of putting on and off the electromagnetic brake.

**CONSTITUTION:** A method for controlling the fluidity of the molten steel in a mold is the method for obtaining a good quality cast slab by controlling while acting the electromagnetic brake force to the discharging stream 3 of the molten steel with static magnetic field 40 and giving the gradient of at least 0.1T/min the variation of the magnetic flux density at the time of changing the magnetic flux density with the static magnetic field 40.

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PUBLICATION NUMBER : 08155605  
 PUBLICATION DATE : 18-06-96

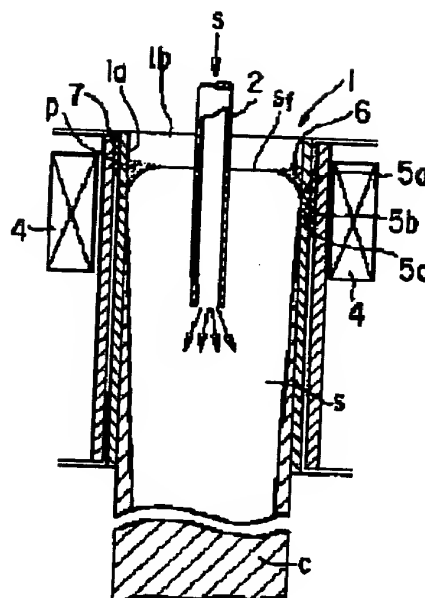
APPLICATION DATE : 09-12-94  
 APPLICATION NUMBER : 06305826

APPLICANT : NIPPON STEEL CORP;

INVENTOR : FUJI TAKEHIKO;

INT.CL. : B22D 11/10 B22D 11/04 B22D 11/04  
 B22D 11/07 B22D 27/02

TITLE : METHOD FOR CONTINUOUSLY  
 CASTING MOLTEN METAL



ABSTRACT : PURPOSE: To generate the pinch force to molten metal in a mold, to reduce the contact pressure between the mold and the molten metal and to promote the feeding of lubricating oil by arranging a low electric conducting layer continued to the thickness direction of the mold and impressing shifting magnetic field in the horizontal direction of a specific frequency with an electromagnetic coil arranged at the outside of the mold.

CONSTITUTION: The mold 1 is formed with copper plates 1a, 1b, and an immersion nozzle 2 for pouring the molten steel (s) from a tundish is arranged at the center part of the mold 1. Then, the molten steel (s) is supplied into the mold from the immersion nozzle 2, and while holding the molten steel surface to the prescribed level, a continuous casting is executed to obtain a cast slab (c). The electromagnetic coils 4 are arranged at the outsides of the copper plates 1a forming long sides of the mold 1 through back plates and the shifting magnetic field in the horizontal direction having 10-1000Hz frequency is impressed. Consequently, the neighbor part of the molten steel (a) surface in the mold is pinched, and the molten steel surface (sf) in the mold 1 is raised and the recessed part 6 of the molten steel surface is formed between the inner surface of the mold 1 and the molten steel surface to promote the feeding of the lubricant (p).

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